Lower Willamette Group (LWG) Reponses to EPA's October 15, 2007 Comments on the Draft Chemical Fate and Transport Model Development and Data Gaps Identification Report – Responses Related Data Needs Only

These responses include only those issues that are potentially relevant to the identification and sampling of any remaining data needs related to the modeling effort. This is to ensure that any needed field work can be conducted as soon as possible to keep the project on schedule. As discussed with EPA, the LWG is also preparing responses to all comments with regards to other issues raised on the structure, function, coding, and use of the fate and transport model. These more general responses will be presented to EPA in the near future to facilitate agreements on use of the model for the project.

Note any comments that are skipped in the responses below do not pertain directly to data needs issues, and will be addressed in a later comprehensive response to comments document. The comment numbers have been added to provide ease of reference between responses.

Comment 1 Section 3.1.2, p. 27, 1st paragraph: An active sediment layer of 30 cm is very thick, especially for a freshwater environment. Please provide references to support this use of such a large active layer. This thickness should be included in the sensitivity analysis since it is expect the model response may be fairly sensitive to this parameter. This assumption is very important, and the rationale should be well documented. Given the low decay of 4,4 –DDD in sediments, natural recovery is largely going to happen through the replacement of initially contaminated sediments with new sediments from upstream. The rate of change of sediment quality is directly proportional to the active sediment depth. In addition, there should be a caveat about big events when discussing the active depth. During events, the bed may erode deeper than this assumed active depth. The simulation in this document represents conditions in the absence of big events. A big event could "activate" deeper contaminated sediments and also cause major sediment replacement, and these conditions are not simulated by this model. EPA suggests that the HST model should be used to approximate the likelihood of this happening, how significant an event such as this would be (i.e., over how much spatial area would these effects be seen at the site), and the potential scour depth associated with such events. This step will allow an evaluation of whether to incorporate this process. Currently, higher flows/events may be simulated in the AFT model through importing flow arrays from EFDC characterizing such events, but these high flows will only act on the surficial sediments.

Response: The comment discusses whether to incorporate deep erosional processes (deeper than the 30 cm mixed layer) into the model. Incorporating such deep erosion into the model would require a substantial restructuring of the existing model including the addition of an explicit buried sediment layer component. If such restructuring was undertaken, it is possible that additional data needs might be identified to support the parameterization of this new portion of the model. *Without a specific model structure change under consideration, identification of those data needs is impossible at this time.*

Comment 2 Section 3.1.2, p. 27, 2nd paragraph: For simplicity, the basic model simulates movement of chemical, not sediment, mass. Thus bed load transport, changes in sediment mass or volume or depth of active sediment are not addressed by this model. If these are considered important processes, then a more complex model (such as the HST with chemical transport features) should be used. Because bedload transport is generally restricted to coarser grained sediment within the river channel and because these coarser grained sediments have much lower concentrations of contamination than finer grained cohesive sediments, the assumption that bedload transport is reasonable. However, EPA requests that further evaluation be performed to confirm this assumption. For example, an evaluation of the degree to which contaminants absorb to different particle size and the size class distribution of bed sediments at the site. In addition, it is important that other elements such as the active depth of sediment are important to our overall understanding of contaminant fate and transport processes even though they are not accounted for specifically in the overall hybrid model. In the case of active sediment depth, this information may be developed by the HST model and utilized to develop a better understanding of the maximum erosion depth for the purposes of the feasibility study and other site evaluations.

Response: The comment (and several later comments) calls for further evaluation of the importance of bedload movement to chemical transport. The example evaluation noted would require analysis of chemical mass by sediment grain size category. Site-specific information of this type does not exist to conduct such an evaluation. However, it appears likely that literature information exists on this issue for contaminated sediments in general. We would recommend such a literature search to evaluate whether large grain sizes moved via bed load transport could contain substantial chemical mass. If EPA disagrees with such an approach, a site-specific data need may exist. If after further evaluation (either based on literature or site-specific information) EPA requests that bedload movement be incorporated, this would require a major restructuring of the model. *As discussed in the previous response, such restructuring could lead to additional data needs that cannot be identified at this time.*

Comment 3 Section 3.3.1.7 (3.1.3.7?), p.33: This section states that once chemical mass is lost to the buried sediment layer, it is no longer tracked by the AFT Model and cannot re-enter the model domain. This assumption is fine if the river sediments are always depositional and the active sediment layer is increasing, but does not represent occurrences when higher flow regimes erode the sediments and expose buried sediments, which may be an important function in the Lower Willamette River. EPA suggests that the EPA and LWG technical staff discuss this and determine if additional changes to the model should be made to reflect resuspension of buried contaminated sediments.

Response: The comment calls for discussion of the need to include a buried layer in the model and erosional exposure of that layer. See response to Comment 1.

Comment 4 Section 3.2.2, p. 38, last paragraph: This paragraph states that the value used for HLS was 100,000 days, but Section 3.3.1 (p. 41) states that the value of 2,291 days was used in the model. What is the source of the value 2,291 days? What is the source

of the value 100,000 days? The report should clarify the difference in these values and how they are used in the model. It seems that some resolution should be made on the value used in the model. Further, research conducted for DDx degradation for the NTC RA at T4 indicates that the breakdown products of DDx are also toxic; thus, bringing to question whether it matters if a half-life for DDx is warranted in the model. This issue should be resolved before conducting further runs of this chemical in the model. Additionally, the chemical half-life for any other chemicals that would be run in the model should also be examined.

HLS should not be used as a calibration parameter because of the inability to calibrate to the change in sediment concentration over time due to lack of long term monitoring, sampling resolution, etc. Instead, an appendix should be added to the document that describes how HLS was estimated in the cited literature (e.g., via model calibration, laboratory studies, etc.). If the "no observed degradation" finding in some of the literature is reasonably well-supported, EPA recommends using a conservative, "no degradation" assumption in the model for 4,4-DDD.

Response: The comment indicates that perhaps zero degradation should be assumed for DDx compounds given that one toxic species can convert to another toxic species. Modeling the conversion from one toxic chemical to another would require simultaneous solutions for all fate and transport equations for all chemicals involved in such conversions and is beyond the capability of this modeling framework. Assuming that DDx does not degrade is not a correct alternate assumption to this approach as suggested in the comment, because DDx has, in fact, been observed to degrade to other chemicals. A major assumption behind the modeling effort is that a single species of chemical is being tracked with each model run. If EPA cannot agree to that assumption, we cannot move forward with the current modeling approach. *If an entirely different modeling approach is employed, this could have implications for additional data needs that cannot be predicted at this time.*

We also disagree with the portion of the comment indicating degradation rates should not be used as a calibration parameter. Degradation rate (bounded by the literature and, as applicable, extant data, e.g., a later comment states that revisiting historical sediment sampling sites might help determine the degradation rate) is an ideal calibration parameter, because it cannot be easily measured at the site. Further, the model has been shown to be sensitive to this parameter. Other parameters that meet these criteria (i.e., sensitive parameters with little or no site-specific data) also should be considered in calibration. Thus, simply choosing a degradation rate value (zero or otherwise) based on a literature search may produce unreasonable model results (i.e., very rapid increases or decreases in sediment concentrations) that are not supported by available data. The purpose of the sediment data gap sampling is to provide information to calibrate the model or at least refine the range of potential model outcomes in terms of rate of change in sediment concentrations over time. *Consequently, if EPA cannot agree to use of degradation rates as a calibration parameter or a clear alternate calibration approach, LWG sees no purpose in collecting the additional sediment data proposed in the report.*

Comment 5 Section 3.3 - Model Development and Calibration Development:
General Comment 1: The AFT Model is highly dependent on the accuracy or the data inputs; therefore, the AFT Model should be calibrated independently of the hybrid model to ensure that the inputs to the model function accurately. This will need to be completed for each chemical parameter that is to be run in this model. Only chemicals that will bioaccumulate in tissue will be run in the hybrid model; however, other chemicals may be ran using the HST and AFT models for feasibility study (FS) purposes. Thus, it is important to identify all chemicals that will be run in the AFT model to ensure the appropriate data is collected. It is possible that the chemical transport and fate function of the AFT be taken over by the more sophisticated HST.

Response: The last sentence of the comment indicates that the HST model may be used for chemical fate and transport functions currently provided by the AFT model. This would be a major change in the already agreed to hybrid modeling approach. Given EPA's previous direction to the LWG to use the hybrid modeling approach and that the cover letter to these comments indicates this approach as viable, we assume that the option described in this comment is not under consideration. *Converting to use of the EFDC model for chemical fate and transport functions would result in a large set of potential data needs that cannot be identified at this time.*

Comment 6 Section 5 – Research and Data Needs Analysis
Section 5.1 – Hydrodynamic and Sediment Transport (HST) Model: EPA agrees that no additional data other than that data already being collected (e.g., Round 3 surface water, sediment trap data etc.) are required to support the physical modeling (HST model).

Response: This comment indicates there are no additional HST model data needs. The LWG agrees with the comment.

Comment 7 Section 5.2 – Chemical Abiotic Fate and Transport (AFT) Model: Data needs are being driven primarily by the parameters found to be most sensitive and having the most uncertainty. It is noteworthy, however, that the sensitive and uncertain parameters identified in this evaluation may not necessarily be the same as those identified in future evaluations involving other contaminants. EPA agrees that volatilization (KV) and burial (KB) were found to be relatively insensitive parameters. However, it is unclear whether groundwater advection (Vgw, KSW, ELS) is also an insensitive parameter. The evaluation showed that changing the external load to sediment (ELS) term (which is one way to represent groundwater advection) can have a significant impact on the sediment concentrations in the immediate cell receiving the external load. The problem is finding an accurate way to quantitatively characterize such external loads (either as contaminated groundwater plumes or buried sediments). Thus this parameter is not necessarily insensitive, but rather potentially problematic for incorporation in subsequent versions of this model.

Response: This comment indicates that incorporation of data regarding groundwater advection of chemicals may be problematic for the model. *We are requesting clarification on whether EPA is indicating any data need with this comment.*

Alternatively, is there need for discussion on how *existing* groundwater data will be incorporated into the model? We have no reason to expect groundwater to be a large contributor to sediment load for the contaminant responsible for the majority of risk at the site (e.g., PCBs) and likely for the other chemicals that will be assessed with the full hybrid model.

Comment 8 Section 5.2 – Chemical Abiotic Fate and Transport (AFT) Model; Sensitive Parameters:

- EPA agrees that the proposed integration of the stormwater data (already being generated) into the AFT model (via the external load to water – ELW term) represents a relatively easy way to refine future versions of this model with site-specific information on loads not currently being considered.
- The proposed data gathering and research activities aimed at refining the highly sensitive half-life in sediment (HLS) parameter will be of the utmost importance going forward. As acknowledged in this report, the calibrated value for DDD is on the extreme end of the 'realistic' spectrum, based on the, albeit limited, literature research conducted thus far. While a more exhaustive literature search is in order, the proposed re-visiting of historical sediment sampling sites will provide a much clearer, site-specific understanding of the HLS. Note that all contaminants suspected to be examined in future hybrid model runs will need to be analyzed at these sites (assuming they were also measured in the historical samples).
- EPA agrees that the proposed additional sampling of surface water at the upstream boundary of the site during high flow events is also a good idea based on the sensitive nature of the incoming water concentration (CWTin) parameter and the reasons listed in the text. In particular, more data on this parameter may help to refine the relationship(s) between incoming concentrations and other chemical/physical parameters such as flow rates, TSS, etc.
- Development of relationships as described above would allow the incoming chemical concentration to be represented as a dynamic parameter, which is likely much more realistic than the current assumption that CWTin is constant. An attempt was made to elucidate such relationships for this version of the AFT model, but based on the lack of data available, this was not possible.

Response: A response is provided regarding each item discussed in the comment below.

Stormwater – It appears the comment is accepting that the stormwater data currently being collected is sufficient for this issue *and there is no further data need*.

Half life in sediment and sediment sampling – The comment agrees that the report proposed sediment data should be collected for the purposes of potentially assisting in the calibration of the model. The LWG agrees with this comment. Comment 4 appears to potentially state a contradictory position. Per response to Comment 4, *if EPA cannot agree to use of degradation rates as a calibration parameter or a clear alternate*

calibration approach, LWG sees no purpose in collecting the additional sediment data proposed in the report.

Surface water data collection and use – The modeling report proposes surface water data collection, and this EPA comment agrees with that data need. Since preparation of the report, an analysis of the complete Round 2 and Round 3A surface water data set has been completed. The complete Round 3A surface water data set was not available at the time of completion of the modeling report; therefore, consideration of the adequacy of the full data set was not possible and could not be factored into the report recommendations. Based on this subsequent analysis of the complete surface water data set, the LWG currently does not see a need for additional surface water data collection.

Presentation of the complete analysis here in this comment response text is not practical; however, the LWG looks forward to the opportunity to meet with EPA and present and discuss the results of this analysis in detail in the near future. Briefly, the existing data set is well understood and represents the successfully implemented, LWG-designed, and EPA-approved surface water program. The analysis does not indicate any RM 11 surface water data needs for the purposes of the model. A brief summary of the analysis and relevant findings is presented below:

Since submission of the F&T modeling report, the LWG has conducted a detailed review of the full surface water data set to develop an understanding of the results and better evaluate data needs. - The review considered dissolved and particulate iCOC concentrations, river flow rate, sampling event type (low flow, high flow, or stormwater-influenced), sampling location, sampling method, total suspended solids (TSS) concentrations, the fraction of organic carbon (f_{oc}) on TSS, and observed partitioning behavior. To focus the surface water data analysis, four surface water iCOCs were selected for consideration (total PCBs, total dioxins/furans, total DDx pesticides, and PAHs [distinguishing total HPAHs and total LPAHs]). Some of the relevant high points of the analysis are summarized in the following bullets.

- *There are no obvious event-type sampling data gaps on the annual hydrograph at RM 11 (Figure 1).* Round 2 and Round 3A surface water sampling captured four low-flow events, two high flow events, and one stormwater influenced event, per program design. This provided a range of concentrations for the major event types, high- and low-flow conditions, on the river. Additionally, one of the high flow events was a very large event (January 2006), which provided the opportunity to evaluate more extreme conditions against the trends observed for the rest of the dataset. The hydrographs over the sampling periods are superimposed on the average annual hydrograph in Figure 1. Round 2 and Round 3A surface water sampling at RM 11 included all 7[1] field events between November 2004 and March 2007.

[1] Note: A total of 8 sampling events were conducted at RM 11. For the January 2007 event, sampling was completed during the first mobilization, then the entire event was called off when flow rates dropped below target levels. Another set of samples were collected at RM 11 in Feb/Mar 2007 when the field effort was reinitiated for this same target event.

- *The data analysis shows that the chemical concentration data cluster at RM 11 over fairly narrow ranges by event type; therefore, there is no obvious unaccounted for variability in the dataset suggesting a specific data need by event type.* The total (XAD filter plus column) concentration data, distinguished by event type, are presented as a function of flow rate on Figures 2 through 5[2]. iCOC concentrations ranges at RM 11 for the high flow events are relatively small. iCOC concentration ranges for the lower flow rate events are also relatively small, with one primary exception. The exception to the narrow grouping of low flow event concentrations for select iCOCs at RM 11 corresponds to samples collected from the east side of RM 11 or collected during periods of observed runoff from the east side of RM 11, possibly indicating a localized source area. This variability in the data is consistently observed and can be considered in generation of boundary conditions for the model using the existing data set. Further, because these outliers to the narrow ranges appear to occur due to stormwater loading, the stormwater data collected for the site should allow representation of this situation in the model through use in the External Load to Water (ELW) model term. .

- *There is no clear indication that collection of additional data would add to the understanding of the system for the purposes of the primary Fate and Transport Model objective per EPA comments (i.e., a comparative relative analysis of cleanup alternatives).* While additional data always improve the understanding of a system to a certain degree, a large number of additional data points would be needed to take the leap to the next level of understanding of this system (e.g., measurably greater confidence in the concentration ranges by event type for the RM 11 boundary conditions). Specifically, to greatly increase the confidence in concentration ranges by event type, numerous additional samples for each event type would likely be needed. Such a large-scale data collection effort is not warranted based on the existing understanding of the data set and, more importantly, the EPA stated primary model purpose.

- *In summary, the existing dataset provides the needed information to input inflow concentrations at RM 11 for the various flow conditions across the annual hydrograph.* While decisions need to be made in discussion with EPA as to exactly how boundary condition concentrations will be assigned to the inflow hydrograph, there are no gaps in understanding of the data set that suggest the need for collection of additional data at RM 11.

Comment 9 Section 5.2.2.4, p. 73: EPA disagrees with the fourth sentence in this section. The internal water concentrations at any given moment may be relatively unimportant, but that does not preclude the possibility that the time averaged (e.g., daily or weekly) water concentrations would be important. Since the sensitivity of the model to

[2] RM 11 transect sample data were collected as either a single equal discharge increment (EDI) composite or as three individual vertically integrated east-, middle-, and west-channel composites. Figures 2 through 5 do not distinguish between sample collection methods except as noted in fly-out boxes

time averaged water concentrations has not been calculated, and since the time averaged water concentrations would be directly impacted by CWTin, this issue of whether or not more surface water data need to be collected or not needs to be re-examined.

Response: The comment questions the lack of importance of within-Site surface water data and appears to leave open the potential need for more within-Site surface water data. We believe there is a misunderstanding about the model's use of and sensitivity to such data, and this point will be clarified in future reports. Within-Site surface water data are used in the model only to set the initial surface chemical concentrations within each model cell. Whether this initial value is an average of several data points over time (as suggested in the comment) or a single sampled value will not change the use of that value as an input to the model. Further, the sensitivity analysis shows that even when that initial value changes by an order of magnitude it has no discernable impact on modeled surface water concentrations after the first few time steps of any model run. (Note that change of this magnitude would not be expected by averaging surface water data over some time period before entering it into the model.) *Consequently, we continue to see no purpose for collecting more within-Site surface water data consistent with the report conclusions.* Regarding the need for more data on incoming surface water concentrations, see the previous response.

Comment 10 Data Gap Summary:

1. The lack of information for the external load to sediment (ELS) and external load to surface water (ELW) are necessary to calibrate the model. EPA is currently constructing a database that will assist in computation of the loading terms. The LWG should work with EPA, ODEQ and the City of Portland stormwater team to integrate pathway specific loading terms into the AFT Model.
2. It should be recognized that the AFT Model can only be used in a relative sense to evaluate remedial action alternatives in the FS. The model is not intended to develop accurate predictions of future sediment, water and tissue concentrations.
3. Boundary conditions at the upstream end of the study area and the downstream end of the study area are not likely be the same. However, EPA expects that data being collected by LWG in Round 3 may be able to fill this data gap (e.g., collection of surface water data at RM 15, RM 2 and in Multnomah Channel).
4. Surface water data from the micro-layer should be considered as a data gap. The micro layer (the top few millimeters above the sediment-surface water interface) is critical to understanding the relationship between surface water and sediment concentrations.

Response: A response is provided for each item under this comment below.

1. Loading data – It appears that the comment is indicating that loading estimates will be made from existing data and data collected by others. *Please clarify that no other data needs are being identified for external load estimates.*
2. Not a data related comment.
3. Downstream surface water boundary conditions – We agree that the additional surface water data already collected allow us to set reasonable downstream

boundary conditions. Because the model is not sensitive to these downstream conditions (with the exception of the downstream most cells under certain conditions), w*e also agree that further data collection of this type is not needed.*

4. Microlayer sampling – This comment calls for sampling of water at the sediment-surface water interface also known as the benthic boundary layer. However, the comment does not describe how these data would actually be used to inform model input parameters. Currently, the model does not contain any structure that allows for differentiation of surface water other than one vertically integrated chemical mass (or concentration). Thus, we can see no immediate use for this type of data in the current model. *We are seeking clarification from EPA on the purpose and use of the suggested data*.

Comment 11 Section 5.3 – Dynamic Food Web Model (FWM): EPA determined that additional fish tissue data was needed to improve model performance. The data collection effort is currently underway. No other data collection activities are needed to improve the food web model at this time.

Response: *This comment indicates there are no other data needs for the FWM*. We agree with the comment.